

# MISSION AND FLIGHT OPERATIONS IN THE SHUTTLE PROGRAM

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# THE ROLE OF OPERATIONS

- Successful human space flight operations depend on the program management, engineering and operations triad
- Starts with vehicle design, development and test
- In the flight phase, the operations organization provides the facilities, tools, training, and flight control personnel for planning and, in partnership with the crew, executing the real-time operations to meet mission requirements

# OPERATIONS ORGANIZATION STRUCTURE

- Until Shuttle, trajectory design, flight planning, training, flight control, and the facilities were spread across separate divisions and directorates at JSC
- The organizations, their interfaces and their processes were brought together for Shuttle
- The consolidated organizations enabled planning, processing and product streamlining
- Also facilitated contract efficiencies

## OPERATIONS ROLE IN DESIGN AND DEVELOPMENT

- The operations community must be involved in design, development and test to assure the systems designs meet operational requirements
- Baseline Operations Concept developed to scope the crew and ground roles and capability requirements
- Systems schematics developed by Operations were a primary instrumentation design, and failure and reliability analysis tool
- Participated with Crews in cockpit layout reviews
- Test participation – learn system signatures
- Capture of the data base for ops support

# OPERATIONS FACILITIES EVOLUTION

- Early Shuttle Mission Control Center was a carryover from Apollo, Skylab and ASTP
- Mission to mission reconfiguration difficult and costly
- Insufficient program funding for MCC technology modernization
- New(er) MCC in 1998 – workstation configuration – began phase-out of large mainframes
- Flight controllers given more involvement in the design of displays and command capabilities

# TRAINING AND SIMULATORS

- Shuttle fixed and moving base simulator at JSC
- Also cockpit, payload bay mockups and RMS
- Simulators supported as “fleet” vehicles – flight software loads installed nearly simultaneously with SAIL
- Workstation systems models – prep for full sims
- Moving base motion for ascent and landing
- Virtual image generation for window views – ascent, rendezvous, landing
- Improved simulation supervisor tools

# FLIGHT OPERATIONS PREPARATION

- Improved planning and procedures processes and controlled data handovers
- Planning and procedures configuration control further strengthened from Apollo
- Approached aircraft type standardization on flight and malfunction procedures – increased effort on rationale capture
- Increased fidelity and realism in simulations – SMS not a verification facility but surfaced many software and operations issues

# FLIGHT CONTROL

- The basics are the same, the supporting technology and capability have changed radically
- TDRSS provides total voice and data coverage
- GPS provides accurate navigation support
- MCC workstation displays are configurable by the operator – data presentation reflects resource management advantages
- MOIR effective support to the Flight Control Team
- The Flight Controllers, regardless of age, discipline, experience, or badge still exhibit the same teamwork, dedication and skill
- The supporting organizations reflect the same positive, “can do” spirit